Space Weather Technical Forecast

Issued on Friday, 09 September 2022 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence throughout. Chance of further G1/Minor Geomagnetic Storms at first.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low over the past 24 hours, with X-ray activity at GOES16 generally residing in high B-class, with occasional small C-class flares observed. The largest of these flares was a C2.2 observed at 08/1710UTC, which appeared to emanate from an as yet unnumbered sunspot group in the northeastern quadrant. This region is one of six sunspot regions on the solar disc at present. The most noteworthy of these in terms of its size and complexity remains AR3096 (Dai/beta) in the northeastern quadrant, which has shown very slight growth in spot number and area over the past 24 hours. The remaining regions on the disc all are small, magnetically simple and relatively stable.

No Earth directed CME's have been observed, and the previously mentioned CME from a filament eruption on the 7th is expected to miss Earth.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, was indicative of a very slowly waning coronal hole HSS from CH20/+. Wind speeds were predominantly Elevated, generally around 550 km/s at first and then ending the day closer to 510 km/s. Density remained t average level. Total interplanetary magnetic field strength, Bt, was weak at 6nT or below. The north-south component, Bz, varied fluctuated between +4 and -6nT. The phi angle was positive (away from the Sun) throughout.

Geomagnetic activity was Quiet to Active (Kp 2-4), but with a Minor Storm/G1 (Kp 5-) in the 08/06-09UTC interval according to the British Geological Survey.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, was at Background levels.

The high energy electron flux (greater than 2 MeV) was at High levels, with a peak of 22,580 pfu at 08/1800 UTC. The 24-hour integrated electron fluence remained above the Active (1e8 integrated pfu) threshold on a rising trend, with 8.84e8 integrated pfu observed at 09/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be largely Low, with a Slight Chance of becoming Moderate with isolated M-class flares, most likely from AR3096 or the new, but unnumbered region, in the northeast quadrant.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently in the forecast. Under the waning influence of CH20/+ the solar wind speed is expected to start at elevated levels, and then gradually decline through the period. The solar wind may not decrease to reach

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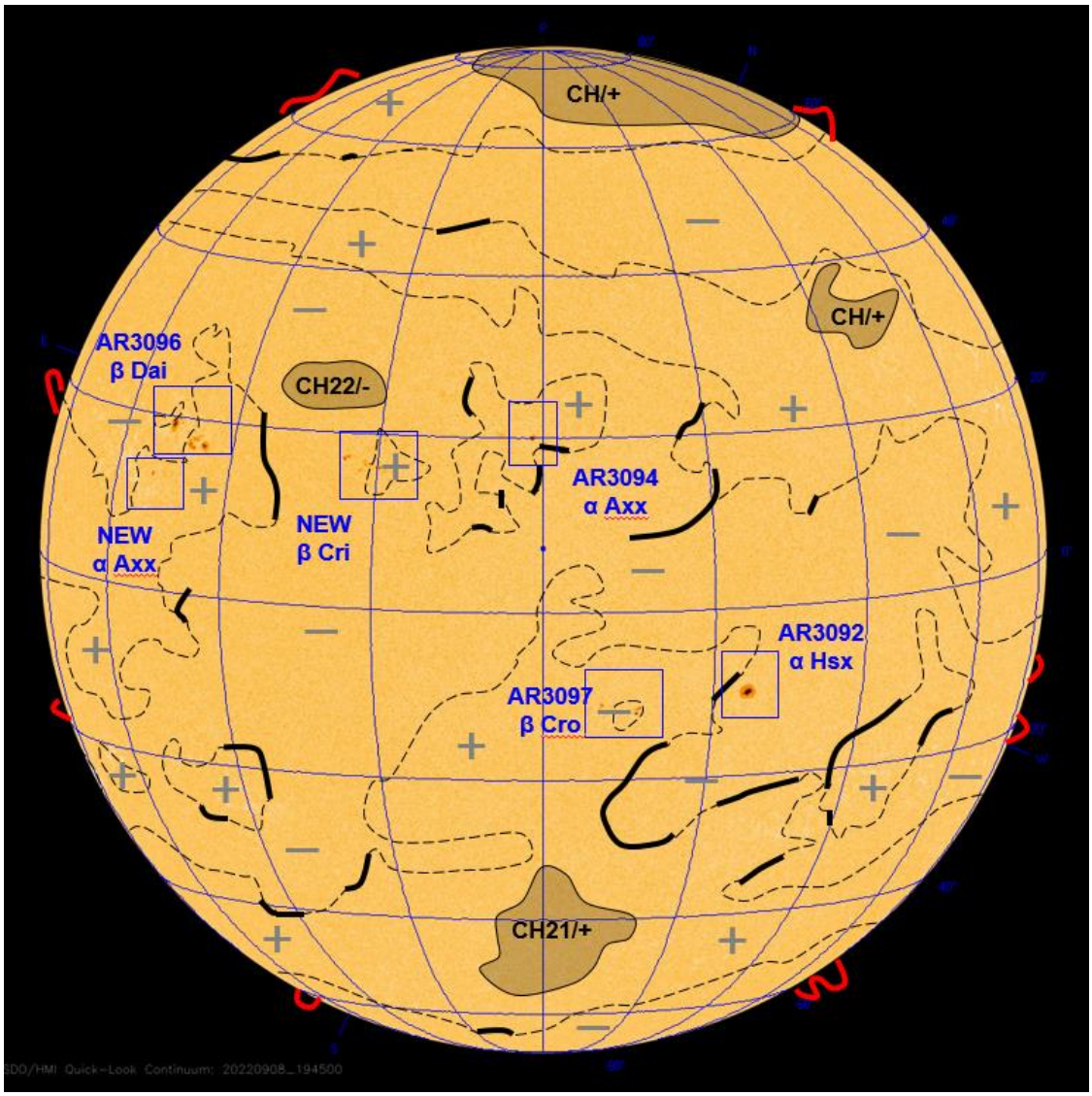
background levels by the end of the period, due to potential weak effects of a HSS from an unnumbered small and faint coronal hole in the northwest quadrant.
Geomagnetic activity will likely be Quiet to Active (Kp 2-4), with a chance of G1/Minor Storm intervals (Kp 5) today (9th Sep). This should slowly ease through the period to become largely Quiet to Unsettled (Kp 1-3) by Day 4 (12th Sep).

Energetic Particles / Solar Radiation: High energy protons (greater than 10 MeV) are expected to remain below S1/Minor radiation storm levels.
The high energy (greater than 2 MeV) electron flux is currently at High levels and are likely to remain High. The corresponding 24-hour fluence is expected to persist above the Active (1e8 integrated pfu) threshold, although later in the period a declining trend is likely. There is a Chance of reaching Very Active (1e9 integrated pfu) at first.

Figure 1. Solar Analysis Valid 08/1945 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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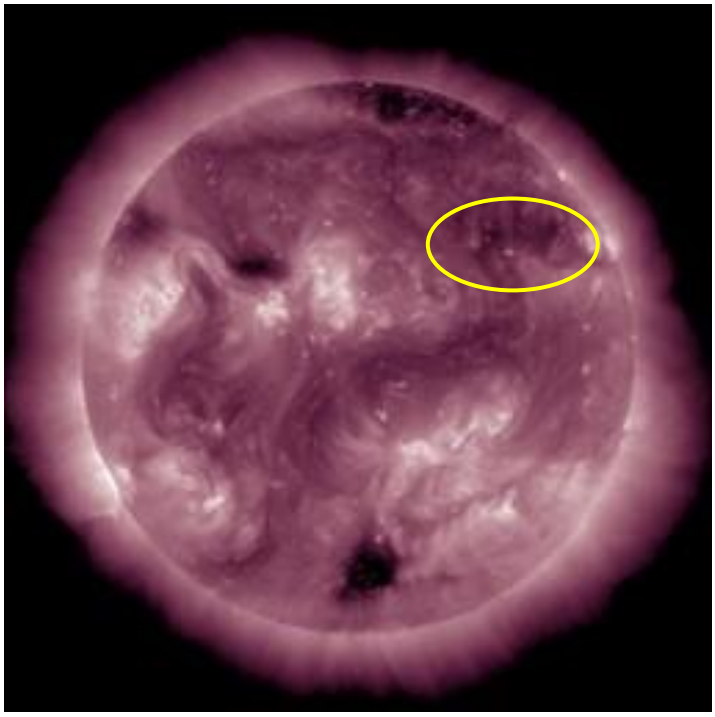
Geomagnetic Storms:

No Earth-directed CMEs are currently expected, as the previously mentioned CME from a filament eruption on the 7th is expected to miss Earth.
Under the waning influence of CH20/+ the solar wind speed is expected to start at elevated levels, and then gradually decline through the period. The solar wind is likely to decline to slightly elevated levels, and may not decrease to reach background levels by the end of the period. This is due to potential weak effects of a HSS from an unnumbered small and faint coronal hole in the northwest quadrant. Both the current HSS from CH20, and any HSS from the small and weak coronal hole in the northwest are positive, which enhances the chance of a geomagnetic response at this time of year.
Geomagnetic activity will likely be Quiet to Active (Kp 2-4), with a chance of G1/Minor Storm intervals (Kp 5) today (9th Sep). This should slowly ease through the period to become largely Quiet to Unsettled (Kp 1-3) by Day 4 (12th Sep).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	50	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest SDO AIA 211 image showing the faint potential CH feature.



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently six sunspot regions on the visible disc. The most noteworthy of these in terms of its size and complexity remains AR3096 (Dai/beta) in the northeastern quadrant, which has shown very slight growth in spot number and area over the past 24 hours. The remaining regions on the disc all are small, magnetically simple and relatively stable, although a new, small and yet to be numbered region in the northwest has developed to become a Cri/beta. Later in the period a new region may rotate onto the visible disc.
Solar activity is expected to be largely Low, with a Slight Chance of becoming Moderate with isolated M-class flares, most likely from AR3096 or the new, but unnumbered region, in the northeast quadrant.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) remains at background values.
The location and lack of complexity of all current sunspots on the visible disc suggest high energy protons (greater than 10 MeV) are expected to remain below S1/Minor radiation storm levels.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	2	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

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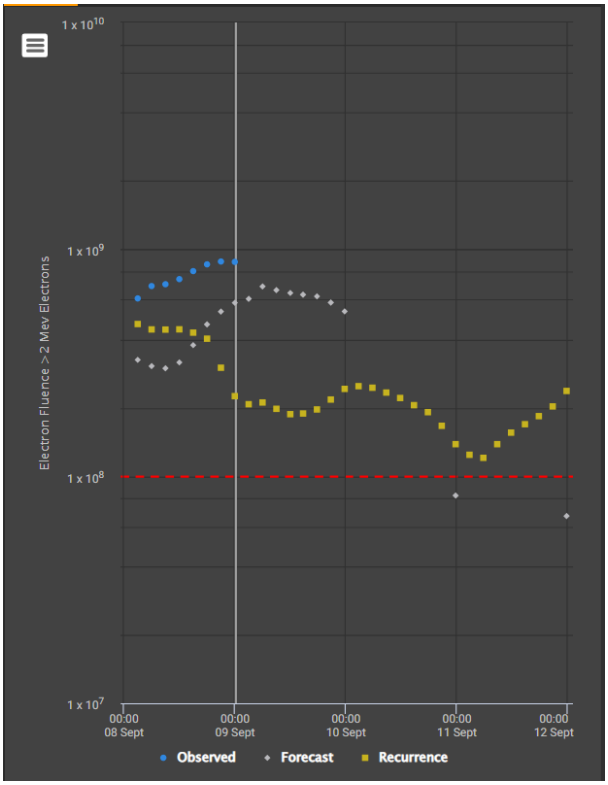
The high energy (greater than 2 MeV) electron flux is currently at High levels due to charging from the HSS from CH20. Flux levels are expected to remain High for much of this period, perhaps on a declining trend later in the period. However, as wind speeds are still elevated perhaps causing some compression of the Van Allen belt, a further rise cannot be ruled out as the radiation belt fully decompresses.

The corresponding 24-hour fluence is expected to persist above the Active (1e8 integrated pfu) threshold, although later in the period a declining trend is likely. There is a Chance of reaching Very Active (1e9 integrated pfu) at first.

REFM is thought to give good guidance at first, with the fluence remaining well above the Active threshold. From day 2 the REFM model is considered too be reducing the fluence too quickly, with above Active threshold values excepted to continue.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	100	100	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	40	40	20	10

Figure 3: Met Office REFM model.



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